Amendments to the drawings

1) The attached sheets of drawings include currently added Fig.7 and Fig.8 .
2) Fig.9 is revised in order to demonstrate that in the second preferred embodiment, the ferrule's inner wall is not unintentionally formed concave, but geometrically calculated paraboloid.
3) By the editorial reason, previous Fig.7, Fig.8 and Fig.9 are renumbered to be Fig.9, Fig.10 and Fig.11 respectively.

Attached replacement sheet

Fig.7 is added in order to show the explanatory drawing of mechanism of the invention especially containing the polyhedral concave wall.

Fig. 8 is added in order to show preferred embodiment which contain the polyhedral concave inner wall.

REMARKS / ARGUMENTS

Regarding to Claim Rejections- 35U.S.C. 102, the current invention is rejected basing upon the 9 anticipated U.S.Patents.

Applicant carefully confirmed all of 9 anticipated U.S.Patents and made remarks respectively.

Applicant would submit the tables attached in page 19−22 of this paper, in order to promote the examiner's reconsider.

For the convenience, summing ups of the result are as follows:

[1] Walter's patent US/4,697,055

He does not apply the shock wave, but pressure waves. Pressure waves are not shock wave.

Please refer the literature attached to clarify the difference.

[2] Nakamura's patent US/5,889,458

He does not apply the shock wave, but thermal radiation rays. Thermal radiation rays are not sock wave.

[3] US/4471185 and 4904977

They do not use shock wave but gas blowout. Gas blow out is not shock wave.

[4]US/569373,3962668,4851806,5262750 and 4926153

There are unintentionally provided concave walls in the enclosure shown in the drawings in cited patents. It is not promised that these concaves have enough geometrically calculated preciseness which enable the shock wave converge and reflect sharply onto the arc spot on the element.

The applicant would be recognized that the fuse which make use of shock wave might have worked first in the world.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted

Tadashi Umeda

Tadashi Umeda

Table 1 Remarks for "Claim Rejections-35USC Clause101"

Ref. Cited	Document/ Inventor	Uses	Means applied for Arc Extinction	Remarks from applicant	Actions of applicant
I	US-4,697,055 Walter et al.	<Claim 1 line 1-2> Self-Expansion and gas insulation switch or circuit breaker <Claim 2 line 1> Arc extinction device according to claim 1 <Claim 3 line 1> Arc extinction device according to claim 1 <Claim 4 line 1> Arc extinction device according to claim 1 <Claim 5 line 1> Arc extinction device according to claim 1 <Claim 6 line 1> Arc extinction device according to claim 1 <Claim 7 line 1> Arc extinction device according to claim 4 <Claim 8 line 1> Arc extinction device according to claim 1 <Claim 9 line 1> Arc extinction device according to claim 4	Acoustic Resonator reflecting <u>pressure waves (plural)</u>	<u>I would submit that "Pressure waves (plural)" used by Walter's invention is not equal to "Shock wave(single)" which I have used.</u> Pressure waves are the premature phenomenon of a shock wave, eventhough they may happen to coalesce to form a single shock wave afterwards. (Please refer the appendix on page 22 of this paper) As far as the pressure waves concern, their speed is nothing faster than the sound, that is far less than a shock wave. Resonated pressure wave enhance its height, however the wave height can be double at most. These give far less energy than the shock wave gives. (Please refer the appendix on page 22 of this paper)	I would submit that no action may be required..

Table 1 Remarks for "Claim Rejections-35USC Clause101" continued

Ref. Cited	Document/ Inventor	Uses	Means applied for Arc Extinction	Remarks from applicant	Actions from applicant
H	US-5,889,458 Nakamura	Fuse	<Claim 1 line 5> Reflecting radiation rays (The cited invention may use <u>thermal radiation.)</u>	1) Shock wave is not applied in cited invention. 2) My invention works in the enclosure filled with sand.	I would submit that no action may be required..
G	US-44,71,185 Richard	Circuit interrupter	<Claim 1 line 10> Gas flowing	Shock wave is not applied in cited invention. My invention works even in the filled sand without any significant gas flow.	I would submit that no action may be required..
F	US-4,904,977 William	Fuse	<Summary of the Invention line 11> Pressurized gas	1)Shock wave is not applied in cited invention. 2)Cited fuse is the explosion fuse which differs from my invention which works even in the filled sand.	I would submit that no action may be required..
E	US-569,373 Downes	Fuse (with half-sphere ferrule) <Fig.1 of the cited invention>	Double cartridge and loosely filled refractory material	The cited half sphere ferrules doesn't look to make the breaking capacity enhanced. Judging from the specification and claims of this invention, <u>it is not clear that these ferrules have such a geometrically precise concave as to converge and reflect the shock wave precisely on the arcing points</u>. I wouldn't imagine any shock wave could have extinguished the arc in this invention.	To be referred the actions for Ref. Cited "D,C,B,A" which have unintentionally formed concave walls in the enclosure.

Table 1 Remarks for "Claim Rejections-35USC Clause101" continued

Ref. Cited	Document/ Inventor	Uses	Means applied for Arc Extinction	Remarks from applicant	Actions from applicant
D	US-3,962,668 Edward	Fuse (Fillered)	Arc quenching filler (The shock wave is not intended to extinguish arc.)	Slightly convexed innner wall (Fig.2 Cited) can not be expected to converge the shock wave on the arcing points to extinguish the arc.	Basically no amendment may be required, however, I understand it is necessaly to avoid any unintentionally formed concave like shown in the fuses cited, I delete clause "or other concave walls" from prior Claim 1 and give clearer definition of its types of the convex wall as precise geomitorical paraboloidal concave and hyperbolic concave in amended Claim 2 . For making sure of it, Fig. 9 (in amended application, 2nd embodiment) is revised so as to demonstrate the precise paraboloidal concaved inner wall. I believe any future fuse may not unintentionally have such a precisely geometrically formed furrule.
C	US-485,106 Heinlich	Fuse	No means applied for Arc Extinction	The conical ferrules can not converge the shock wave on the arcing points to extinguish the arc.	
B	US-5,262,750 Leon	Fuse	Ceramics coating on the fuse element	The cited patent looks to have a half sphere terminal. It can not converge the shock wave. Judging from its specification, Fig.1 and claims of this invention, it is not clear that the ferrules have such a geometrically precise concave as to converge the shock wave precisely on the arcing points.	
A	US-4,926,153 Leon This cite is similar to B.				

Attached*1 : Downloaded from Google by Serching "Presure Wave" → www.aber.ac.uk/~ceswww/reserch/what/shockinfo.html

Appendix 1 Literature

What is a Shock Wave?

Formation of a shock wave in an ideal gas.

The propagation of an ordinary sound or acoustic wave in a gas is accompanied by small amplitude longitudinal displacements of molecules; there is no net flow of gas, and any physical changes in the gas are small and reversible. The velocity of such a wave, termed the local sound speed of the gas, is determined by the collision rate between gas molecules; it is therefore approximately equal to the mean kinetic velocity of the molecules and is primarily determined by the temperature of the gas.

A totally different situation arises when a disturbance is forced through the gas at a speed greater than the local molecular velocity. In this case it is evident that a wave of a very different nature is established in the gas. Since the molecules can only move away from the supersonic (i.e. greater than the sound speed) disturbance at the sound speed, then the pressure, density and temperature must all build up ahead of this disturbance. This situation is analogous to the case of a ship moving through water at a speed greater than the velocity of the surface waves on the water; the water tends to pile up ahead and to both sides of the bows, forming a steep wave of large amplitude known as a bow-wave. This wave is stationary relative to the ship, diverges linearly, and becomes attenuated with increasing distance backwards from the bows. Such a wave, when generated in a gas by a supersonic disturbance, which might be a solid piston or a sharp interface, is termed a shock wave and at its front very steep gradients of pressure, density and temperature occur.

The Becker Model

One of the simplest models which illustrate shock-wave formation is due to Becker [1] and is shown in figure 1. Here, a rigid piston accelerates into a motionless gas in a duct; the acceleration is approximated by a series of small instantaneous increases of velocity occurring after short, finite time intervals. After the first impulsive acceleration at say t=1, a pressure wave (shown as a vertical line) moves along the duct and affects a mass a of gas. This mass starts to move at the piston velocity and has its pressure increased slightly; between t=1 and t=2, the pressure and velocity of a is further increased due to the second acceleration of the piston, the original wave has by now reached b and imparts a pressure and velocity pulse to this mass. This process then continues as shown in the diagram, each pressure wave moving at the local sound speed with respect to the gas through which it passes. However, the masses nearest the piston have both higher velocities and higher temperatures (due to higher pressures) and consequently much higher pressure-wave speeds relative to the duct than masses further away. This causes the pressure waves nearer the piston to overtake those further downstream; eventually all the pressure waves coalesce to form a single steep pressure gradient or shock-wave.

Under Lined by applicant

Searched "Pressure Wave" through Google, and found at
www.aber.ac.uk/~ceswww/reserch/what/shockinfo.html

Literature (continued)

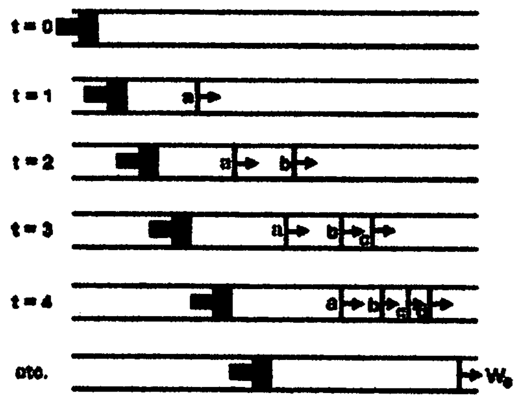

Figure 1 – Schematic model of shock-wave formation

Unlike a sound wave, this large amplitude disturbance changes the physical nature of its supporting gas and so it acquires non-linear characteristics; it also travels at supersonic speed relative to the gas in front. From simplified theory, these large pressure, density and temperature gradients should become infinite; however before this occurs, viscous and heat conduction effects intervene to produce a shock with large, but finite gradients across it.

By applying a similar argument to that given above to the gas behind an accelerating piston, it can be shown that in this region a series of weak expansion waves propagate into the gas and travel at the local sound speed away from the piston. However, in this case each wave travels into a cooling gas with continually decreasing sound speed. Hence, these waves have continuously decreasing speeds and form a gentle and continuously decreasing gradient of pressure, density and temperature, termed the "rarefaction fan".

Equations of normal shocks.

In a conventional shock tube system, the long duct mentioned above is a round or rectangular rigid pipe and the piston is replaced by a rapidly expanding driver gas. The shock is generated in the test section of the tube, initially containing the gas to be shocked. The test sections and driver sections and driver sections are initially separated by a rigid diaphragm, and the sudden rupture of this diaphragm causes the high pressure gas in the driver to expand rapidly, like a piston, into the test gas, forming a shock wave.

The following assumptions are made in the basic theory of shock waves:–

1. The gas flow is one-dimensional
2. The gas is ideal and has constant specific heats.
3. Heat transfer and viscosity effects are neglected.
4. Diaphragm rupture is instantaneous and does not disturb the subsequent gas flow.

By considering the gas flow in shock-fixed co-ordinates and through unit area of the shock, then using the basic conservation equations the following relations are obtained:–

$$\text{Mass} \quad \rho_1 U_1 = \rho_2 U_2 \quad (1)$$

$$\text{Momentum} \quad P_1 + \rho_1 U_1^2 = P_2 + \rho_2 U_2^2 \quad (2)$$